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PROPERTIES OF Hα-SELECTED STAR-FORMING GALAXIES FROM $z \sim 0.8$ TO NOW

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We present a long-term project to study the characteristics and evolution of current star-forming galaxies at different redshifts. Our results support the idea that the higher Star Formation Density measured at redshift z=0.24 is due to an increase of the density of bursting galaxies and not to an intrinsic change on overall galaxy properties.

Introduction

Galaxy evolution during the last half of the life of the Universe is now well established. The period since z $\sim$ 1 until the current epoch has been characterized by clear changes in the overall properties of the Universe such as Star Formation Rate (hereafter SFR) density (Madau et al. 1998). Simultaneously, the galaxy population of the Universe since z $\sim$ 1 has experienced substantial changes. We present a long-term project to study the characteristics and evolution of current star-forming galaxies at different redshifts. The selection of the samples is carried out in an homogeneous way by detecting Hα emission-line objects in deep images taken with narrow-band filters tuned to the corresponding wavelength for a given redshift. Target redshifts are z = 0.24, z = 0.4 and z = 0.8. Here we present photometric redshifts, emission-line luminosities and multi-band photometry for a sample of emission-line galaxies at z = 0.24, selected by their contrast in a narrow band filter centered in the 8200Å atmospheric window. The physical properties of these galaxies appear to be remarkably similar to those of local galaxies selected in the same way. Our results support the idea that the higher Star Formation Density measured at redshift z = 0.24 is due to an increase of the density of bursting galaxies and not to an intrinsic change on overall galaxy properties.

The survey

Our goal is to build homogeneous samples of current star-forming galaxies covering the redshift range from z $\sim$ 1 to the current epoch. The objects are selected by their flux excess in a narrow-band filter centered at the wavelength corresponding to H$\alpha\lambda$6563Å redshifted at the target redshift (see Figure 1). At this moment, optical filters at 8200Å and 9200Å have been used to study the z= 0.24 and z = 0.4 universes. Work at 11810Å is in progress to study the z = 0.8 universe.

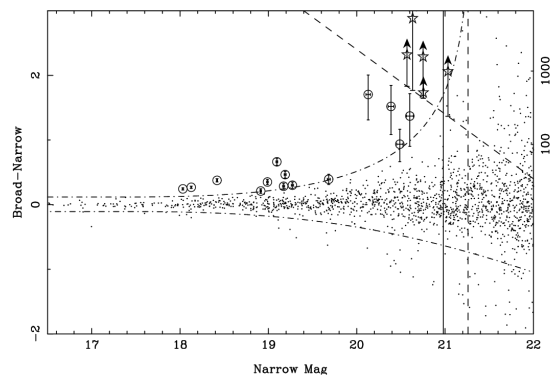

Fig. 1. Candidate selection Broad-Narrow vs. Narrow mag for a INT field. Dashed curve represents the 3σ detection limit (determined by EW as a function of apparent magnitude). The diagonal dashed line is the limiting broad magnitude. Dashed vertical line is the limiting narrow mag. Open circles are candidates selected. Star-shaped points are objects selected below the limiting broad band magnitude.

Overall properties of Hα emitters at $z = 0.24$

Here we analyze the sample of candidates to emission-line galaxies used by Pascual et al. (2001) to estimate the Hα-based SFR density of the Universe at z = 0.24. In that paper, we presented deep images taken with the 2.2m telescope of Calar Alto Observatory (Almería, Spain) on the ELAIS-N1 region (Rowan-Robinson & Elais Consortium 1999) using a narrow band filter centered in 8200Å with a FWHM of 160Å and a broad-band filter to probe the continuum. This specific narrow-band filter was selected because at 8200Å there is a substantial gap in the sky-night OH emission lines.

Deep multi-band photometry for our sample was obtained from the INT Wide Field Survey (hereafter INT-WFS). Our field was imaged with five fil-

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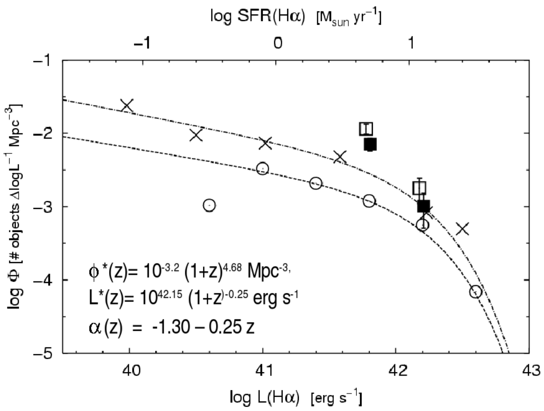

Fig. 2. Hα luminosity function at z = 0.24. Luminosity function of the 33 objects, down to 7.2 10^{-16} erg s^{-1} cm^{-2}, at z = 0.24 (filled squares), compared with the luminosity functions and Schechter best fit of Gallego et al. (1995; z = 0.02; open circles) and Tresse & Maddox (1998; LF asterisks). The relevance of [O II]3727 and [O III]5007 emitters is reflected by the LF empty squares values, where no contaminants were removed from the sample.

ters (U g r i z), ranging from 3664Å (U filter) to 8953Å (z filter). Limiting magnitudes were $\sim$ 22.9 in the broad band and $\sim$ 21.0 in the narrow band. There were 61 objects in the original sample. 16 of them were marginal detections, detected only in the narrow band filter. Stars were flagged using the stellarity parameter `CLASS_STAR` given by Sextractor (Bertin & Arnouts 1996).

In order to discriminate between genuine Hα emitters and potential sources of contamination, i.e. stars and other emission line objects ([O III]5007 at z $\sim$ 0.64, Hβ at z $\sim$ 0.68 or [O II]3727 at z $\sim$ 1.2), photometric redshifts were computed through a standard minimization procedure, using the public code *hyperz* (Bolzonella et al. 2000). Based in both the stellarity and photometric redshift, 13 objects were finally classified as stars and 33 objects were confirmed as Hα emitters at z = 0.24. This number is compatible with the one obtained evolving with a $(1+z)^3$ the local Hα luminosity function obtained by Gallego et al. 1995 (see Figure 2). We have found 6 candidates to be galaxies at z $\sim$ 0.6 and 3 at $\sim$ 1.2. The presence of these objects at these relatively bright fluxes implies a stronger evolution of the population of [O III]5007 and [O II]3727 emitters than the corresponding to Hα.

We find a total extinction-corrected Hα luminosity density of (4.6$\pm$0.3) 10^{39} erg s^{-1} Mpc^{-3} at z = 0.24. Assuming a constant relation between the Hα luminosity and star formation rate, the SFR density

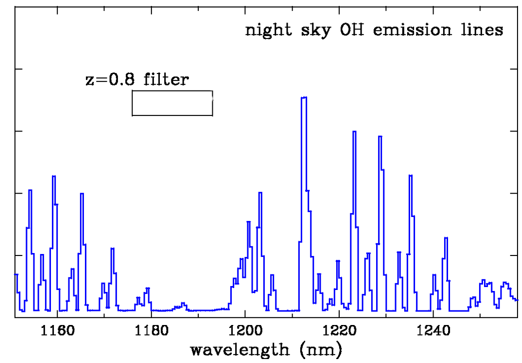

Fig. 3. High-resolution spectrum of the sky in the near-infrared region centered at 11810Å. The wavelength region covered by our 100Å narrow-band filter is marked as 'z = 0.8 filter'. Note that it was selected to be centered at the minimum sky emission.

in the volume covered is (0.036 $\pm$ 0.002) M$_\odot$ yr^{-1} Mpc^{-3}. This value is a factor of $\sim$ 3.8 higher than the local SFR density and consistent with the strong increase in the SFR density from z = 0 to z = 1.

Hα emitters at z = 0.24 exhibit properties similar to the local analogs, in distribution of Hα fluxes and equivalent widths. The downsizing scenario (Cowie et al. 1996), in which rapid star-forming galaxies evolve smoothly in luminosity with decreasing redshift, seems to be a possible model to explain the evolution of these galaxies.

Hα emitters at z = 0.8

Our principal aim now is to obtain a statistically representative sample of Hα star forming galaxies at z $\sim$ 0.8. In order to do this we have designed and bougth a 100Å narrow band-filter centered at the wavelength of Hα redshifted to z $\sim$ 0.8 (11810Å). The filter covers a wavelength region where the nigth sky emission shows a local minimum (see Figure 3). Deep near IR images taken using our narrow band filter are under analysis.

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